R E M A R K S

Reconsideration of this application, as amended, is respectfully requested.

THE CLAIMS

Independent claim 1 has been amended to clarify that the liquid ejection apparatus of the present invention comprises an opposing electrode. In addition, independent claim 1 has been amended to clarify that the liquid ejection head has: (i) plural nozzles arranged on a same plane facing a same direction so as to face the opposing electrode, each of the nozzles having an inner diameter of at most 15 μm, (ii) a flexible base layer, (iii) an insulating layer formed over an entire surface of the flexible base layer, (iv) a flow channel layer which has a solution chamber and a supply channel for each of the nozzles, and which is positioned over the insulating layer for forming the supply channels of a solution, (v) a nozzle plate which has the nozzles and which is formed over the flow channel layer, and (vi) an ejection electrode which is arranged at an entire boundary between the flow channel layer and the nozzle plate.

Still further, independent claim 1 has been amended to clarify that the ejection voltage supply applies an ejection voltage to the solution inside the nozzles via the ejection electrode so as to charge the solution in the solution chambers,

wherein the ejection voltage supply includes the ejection electrode which contacts with the solution to charge the solution, and the liquid ejection apparatus further comprising the convex meniscus generator: (i) which has a piezoelectric transducer and a drive voltage supply for applying a drive voltage to the piezoelectric transducer to deform the piezoelectric transducer, and (ii) which is provided for each of the nozzles, to cause the solution inside each of the nozzles to rise therefrom in a convex shape.

Yet still further, independent claim 1 has been amended to clarify that the operation controller controls the ejection voltage supply to apply a voltage which has a reversed polarity to the ejection voltage to be applied by the ejection electrode, and which is applied to the solution inside each of the nozzles via the ejection electrode just before or just after the ejection voltage is applied to the solution inside each of the nozzles.

See Figs. 1 and 4, and corresponding disclosure in the specification.

In addition, claims 3, 9, 10, 12, 14 and 16-20 have been amended to better accord with and/or directly depend from amended independent claim 1.

No new matter has been added, and it is respectfully requested that the amendments to the claims be approved and entered.

THE PRIOR ART REJECTION

In the Final Office Action, claims 1, 3, 4, 7 and 9-20 were again rejected under 35 USC 103 as being obvious in view of the combination of previously cited USP 5,477,249 ("Hotomi"), previously cited USP 6,017,112 ("Anderson et al") and previously cited USP 6,382,754 ("Morikoshi et al"). These rejections, however, are again respectfully traversed with respect to the claims as amended hereinabove.

According to the present invention as recited in amended independent claim 1, an electrostatic attraction type liquid ejection apparatus is provided which comprises an opposing electrode, and a liquid ejection head having: (i) plural nozzles arranged on a same plane and facing a same direction so as to face the opposing electrode, each of the nozzles having an inner diameter of at most 15 μm, (ii) a flexible base layer, (iii) an insulating layer formed over an entire surface of the flexible base layer, (iv) a flow channel layer which has a solution chamber and a supply channel for each of the nozzles, and which is positioned over the insulating layer for forming the supply channels of a solution, (v) a nozzle plate which has the nozzles and which is formed over the flow channel layer, and (vi) an ejection electrode which is arranged at an entire boundary between the flow channel layer and the nozzle plate.

As recited in amended independent claim 1, the ejection apparatus further comprises an ejection voltage supply to apply an ejection voltage to the solution inside the nozzles via the ejection electrode so as to charge the solution in the solution chambers, the ejection voltage supply including the ejection electrode which contacts with the solution to charge the solution, a convex meniscus generator: (i) which has a piezoelectric transducer and a drive voltage supply for applying a drive voltage to the piezoelectric transducer to deform the piezoelectric transducer, and (ii) which is provided for each of the nozzles, to cause the solution inside each of the nozzles to rise therefrom in a convex shape, and an operation controller to control application of the drive voltage to drive each convex meniscus generator and application of the ejection voltage by the ejection voltage supply so that the drive voltage to each convex meniscus generator is applied in a timing corresponding to the application of a pulse voltage as the ejection voltage by the ejection voltage supply.

In addition, as recited in amended independent claim 1, the operation controller controls the ejection voltage supply to apply a voltage which has a reversed polarity to the ejection voltage to be applied by the ejection electrode, and which is applied to the solution inside each of the nozzles via the ejection electrode just before or just after the ejection voltage

is applied to the solution inside each of the nozzles. See, for example, Figs. 1 and 4 and corresponding disclosure in the specification.

With this structure of the claimed present invention, since the operation controller controls the ejection voltage supply to apply a reversed polarity voltage to the solution inside the nozzles just after the ejection voltage is applied to the solution via the ejection electrode (Fig. 4), several significant advantageous effects are produced whereby an electro-wetting effect, excessive concentration of particle substances in the solution at the top portion side of the nozzle, and the influence on charge-up, which are caused by application of the ejection voltage, can be canceled, and the next ejection can be maintained in a good state.

It is respectfully submitted that none of the cited references, either separately or in combination, discloses or suggests the above described claimed structural features and advantageous effects of the present invention as recited in amended independent claim 1.

On pages 3 and 4 of the Final Office Action, the Examiner acknowledges that Hotomi does not disclose the feature of the present invention whereby "the operation controller controls the application of a voltage having reversed polarity to the ejection voltage to be applied by the electrode to the solution inside the

nozzle just before or just after the ejection voltage is applied to the solution inside the nozzle." For this reason, the Examiner has cited Morikoshi et al.

It is respectfully pointed out, however, that Morikoshi et al merely discloses a control method of a piezoelectric vibrator. By contrast, the claimed present invention is directed to regulation of an electrostatic charge. In particular, according to the present invention as recited in amended independent claim 1, a voltage which has a reversed polarity to the ejection voltage is applied to the solution inside each of the nozzles via the ejection electrode.

It is respectfully submitted that Morikoshi et al merely discloses applying driving voltage signals to a piezoelectric vibrator (not to a solution inside nozzles). In this connection, on page 9 of the Final Office Action, according to the Examiner, the "voltage waveforms shown in figs. 5(e), 6, 24(a) [of Morikoshi et al] are similar to the wave form shown in fig. 4 of [the present application.]" Applicants respectfully disagree and respectfully point out that the reverse polarity voltage shown in Fig. 4 is for the ejection voltage (not the drive voltage), whereas in Morikioshi et al the reverse polarity is shown merely for the driving pulse.

Therefore, it is respectfully submitted that since the driving pulse voltages of Morikoshi et al are merely applied to a

piezoelectric vibrator (ejection actuator), Morikoshi et al does not at all disclose or suggest the feature of the present invention as recited in amended independent claim 1 whereby a voltage, which has a reversed polarity to the ejection voltage, is applied to the solution inside each of the nozzles via the ejection electrode. And clearly therefore, the driving pulse of the piezoelectric vibrator of Morikoshi et al does not achieve the advantageous effect achieved by applying the reversed polarity ejection voltage to the solution as according to the claimed present invention whereby an electrostatic charge is reduced or balanced out.

It is respectfully submitted, moreover, that Hotomi does not disclose or suggest the liquid ejection head and the convex meniscus generator having the structure recited in amended independent claim 1.

Still further, it is noted that Anderson et al has merely been cited for the disclosure of a nozzle with an inner diameter of at most 15 μm.

Accordingly, it is respectfully submitted that even if all of Hotomi, Anderson et al and Morikoshi et al were combinable in the manner suggested by the Examiner, any such combination would still not achieve or render obvious the structural features and advantageous effects of the present invention as recited in amended independent claim 1.

In view of the foregoing, it is respectfully submitted that amended independent claim 1, and claims 3, 9, 10, 12-20 depending therefrom clearly patentably distinguish over Hotomi, Anderson et al and Morikoshi et al, taken singly or in any combination consistent with the respective fair teachings thereof, under 35 USC 103.

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Entry of this Amendment, allowance of the claims and the passing of this application to issue are respectfully solicited.

If the Examiner has any comments, questions, objections or recommendations, the Examiner is invited to telephone the undersigned at the telephone number given below for prompt action.

Respectfully submitted,

/Douglas Holtz/

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